Small Business Innovation Research/Small Business Tech Transfer

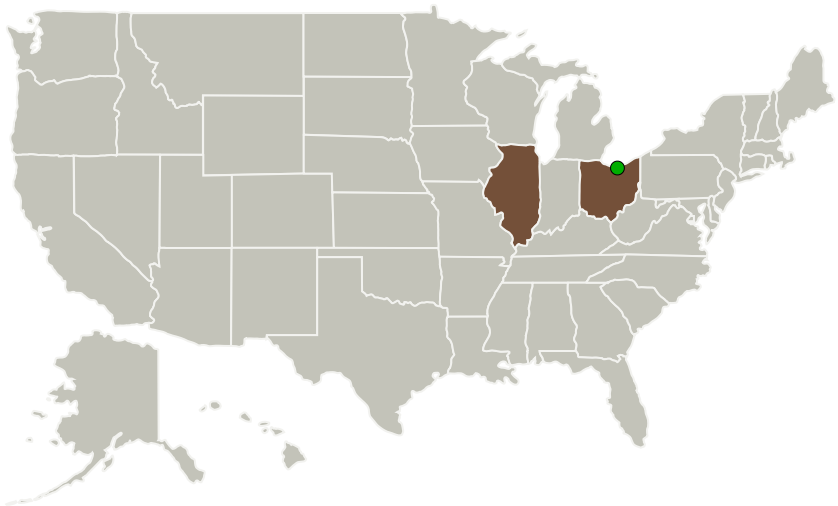
Multi-Mode Micropropulsion, Phase I

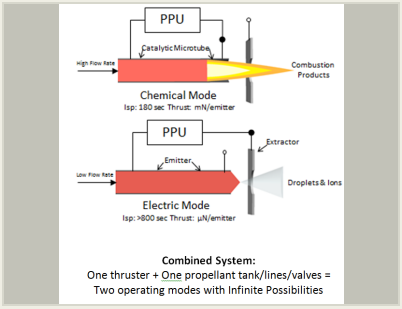
Completed Technology Project (2017 - 2017)

Project Introduction

This project will further development of a thruster capable of both chemical monopropellant and electrospray propulsion using a single "green" ionic liquid propellant. the thruster concept consists of an integrated microtube/electrospray thruster that shares all propulsion system hardware between electric and chemical thruster modes, i.e. one propellant, one propellant tank, one feed system, and one thruster. Thus, the thruster is not significantly more massive than a standalone state-of-the-art chemical or electric thruster, but capable of either thrust mode and selectable as mission needs arise. This has several benefits, including the optimization of trajectories using both chemical and electric thrust manuevers as well as a significantly increased mission design space for a single propulsion unit. The propulsion system is capable of both high impulse per unit volume and high thrust per unit volume as the total impulse per unit volume is 1500 N-s/U in the chemical thrust mode and 2750 N-s/U in the electric thrust mode, where either type of manuever could be selected on-the-fly. The specific objectives for this study are to build a single microtube setup and feed system and test both the chemical monopropellant mode and electrospray mode with the same setup. This setup will allow verification of thruster models stemming from previous chemical mode tests, verify electrospray operation at lower flow rates than we have previously tested, and study the interactions in switching from the chemical mode to the electric mode and vice-versa with specific attention paid to potential life limiting mechanisms. As an additional part of this contract, we will work in parallel to investigate techniques required to manufacture multi-emitter arrays and conduct fluid flow and electrostatic simulations to further develop the preliminary thruster design.

Primary U.S. Work Locations and Key Partners





Multi-Mode Micropropulsion, Phase I Briefing Chart Image

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Froberg Aerospace, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

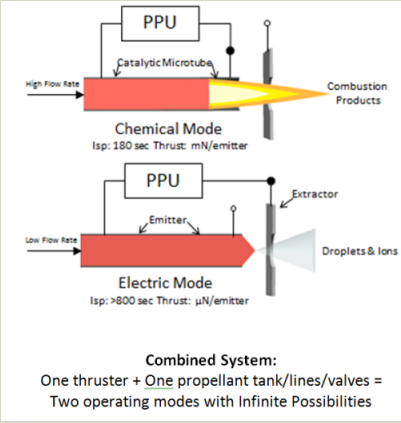
Multi-Mode Micropropulsion, Phase I

Completed Technology Project (2017 - 2017)

Organizations Performing Work	Role	Type	Location
Froberg Aerospace, LLC	Lead Organization	Industry	Rolla, Missouri
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Illinois	Ohio

Images



Briefing Chart Image
Multi-Mode Micropropulsion, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/135688)*

Project Management

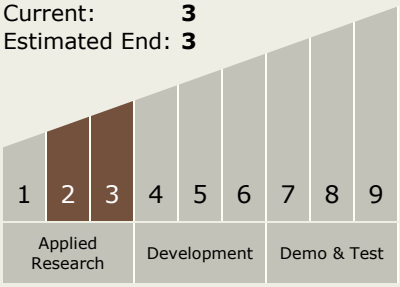
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Steven P Berg

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic